DOCUMENT RESUME

ED 320 985 UD 027 503

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TITLE Improving African American Youth's Standardized Test Scores: A Program of Study in Science, Mathematics, and Technology.
PUB DATE 19 Apr 90
NOTE 35p.; Paper presented at the Annual Meeting of the American Educational Research Association (Boston, MA, April 16-20, 1990).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Black Students; *College Preparation; Conferences; *Critical Thinking; Culture Fair Tests; Minority Group Children; Program Evaluation; *Science Programs; Secondary School Students; *Self Esteem; Standardized Tests
IDENTIFIERS Ravens Coloured Progressive Matrices; *STEP Program

ABSTRACT

More than half the minority group students who completed the 1988/89 Science and Technology Entry Program (STEP) at Manhattanville College (New York) scored in the 90-95 percentile on tests of critical thinking, suggesting ability to do well in mathematics, science, and other studies. STEP comprises the following goals: (1) enable students to enter and persist in college preparatory courses by teaching essential critical thinking, study, organizational, communication, scientific, and mathematical skills; (2) promote self-esteem and self-confidence; and (3) develop career awareness through exposure to minority role models. Fifty-two predominately black 7th-, 9th-, and 11th-grade students completed the first year summer and academic components of the program. A variety of standardized tests and measures were used to evaluate student progress, including the Preliminary Scholastic Aptitude Test (PSAT), the Rosenberg Self Esteem Scale, and the Ravens Coloured Progressive Matrices. Analysis of student scores indicates that their self-esteem was positive and their performance on standardized tests was acceptable. The discrepancies between scores on tests of critical thinking and scores on standardized tests suggest that the program should increase emphasis on critical thinking skills and align the content of mathematics and science modules more closely with those of the regular school curriculum. This study is intended to become the first part of a 3-year longitudinal evaluation. Statistical data are included on eight tables. A list of 15 references is appended. (FMW)

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IMPROVING AFRICAN AMERICAN YOUTH'S STANDARDIZED TEST SCORES: A PROGRAM OF STUDY IN SCIENCE, MATHEMATICS, AND TECHNOLOGY

by

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A Paper Presented at the Annual Meeting of the
American Education Research Association
April 19, 1990
Boston, Massachusetts

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Abstract

The Science and Technology Entry Program (STEP) was funded by the New York State Education Department at Manhattanville College in August 1988 to: 1) enable STEP students to enter and persist in college preparatory courses by providing them with essential critical thinking, study, organizational, communication, scientific, and mathematical skills necessary for academic success, 2) promote students self-esteem and self-confidence, and 3) expand student's career awareness. Fifty two 7th, 9th, and 11th graders completed the first year summer and academic components of the program. This paper reports the results on students' critical thinking, self-esteem, and standardized scores after one year in the program. More than half of the STEP students scored in the 90-95 percentile on tests of critical thinking indicating likely ability to do well in math, science, and other studies. In general the self-esteem of STEP students was positive and their standardized test scores were acceptable. Tracking their achievement through the second year of the program, comparing the results of the first cohort of STEP students with the second cohort, and comparing their results with a matched group of non STEP students remain to be done.

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Improving student achievement and thus the chances of minority students to be admitted to the more select colleges has been a goal of numerous high school and college programs (Williams, 1987; Comer, 1987). Lower standardized scores, insufficient college preparation courses, and lack of a science and math background are but some of the reasons for colleges rejected minority students applicants. Closing this achievement gap has called for an accelerated approach to schooling (Levin, 1987).

In this spirit, faculty members of Manhattanville College and Woodlands High School in the Greenburgh #7 School District worked together to develop and implement a program of study and skill development for minority youth which focuses specifically on the sciences, mathematics, and technology. Manhattanville College possesses two critical elements required for a model Science and Technology Entry Program (STEP) program: an academic program that takes into account the needs of each individual and an impressive success rate with students from a wide range of educational and social backgrounds. Woodlands serves a diverse population of students. While many go on to college, there are a

significant number of minority students at Woodlands who are not in academic programs or courses of study which will lead to careers in math science professions. The STEP program uses the College to augment the high school program thus providing STEP students with academic support throughout their secondary schooling, and with the skills, knowledge and attitudes necessary to pursue higher education and careers in mathematical, scientific and technological fields.

The Manhattanville-Woodland STEP Program involves an intensive month of study at the College during the summer and weekly activities at the College during the academic year. Eleventh and twelfth grade students are involved in internships at various business and scientific sites throughout the Westchester area. In the first year, the program was designed to accommodate sixty students in three cohort groups: twenty seventh graders, twenty ninth graders, and twenty eleventh graders. In the second and subsequent years, the program will incorporate one hundred-twenty students. The aims of the Manhattanville-Woodlands STEP Program are to:

1. Enable STEP students to enter and persist in college preparatory courses during high school by providing them with the essential critical thinking, study, organizational, communication, scientific and mathematical skills necessary for academic success.
2. Promote STEP students' entry into higher education and careers in fields which involve the disciplines of

mathematics and science through their participation in a systematic program of study in math and science.

3. Promote STEP students' self-esteem and self-confidence through a series of academic and social activities, thus enabling them to succeed personally and professionally in school and careers.
4. Expand STEP students' career awareness through exposure to minority role models and internship and volunteer service experiences, thus broadening their career choices.
5. Develop a model program comprised of instructional modules in the areas of math, science and technology, and counseling for skill development and career planning which can be replicated.

The program is enhanced by the support of parents and students who participate in planning, educational and technical consultants, counseling and academic support staff from the high school and the college, and minority career mentors who work with small groups of students throughout their years in the program.

The program is administered by Manhattanville College through the STEP program director, a person who combines expertise and knowledge in the fields of mathematics, science and technology, and a support staff. The program features an advisory board composed of college faculty and administrators, Greenburgh school district faculty and administrators, parents, and minority business leaders and educators who provide guidance. Staff development focusing on analytical thinking skills,

cooperative learning strategies and multicultural education is provided for faculty and staff from both institutions.

DESCRIPTION OF THE STUDY

The assessment of the Manhattanville-Woodlands High School STEP Program in this study covers the period from August 1988 to June 1989. The information presented here is intended to become part of a longitudinal study and a detailed examination of the program over a three year period.

Evaluation studies, such as this one, recognize that the program is dynamic, that is, that it is in operation, changeable and taking place in a naturalistic or field setting. While experimental rigor is applied when appropriate, it is necessary to augment the study with descriptions of contextual variables and to utilize the methodologies and perspectives of various disciplines to understand the processes and functioning of the program.

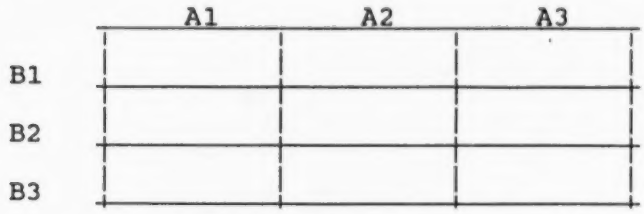
The objectives of the study are to assess and monitor the progress and performance of STEP students with regard A1) critical thinking, A2) self-esteem, and A3) standardized tests.

DESIGN

Our approach is based on a pragmatic philosophy that results in a quasi-experimental design. The longitudinal nature of the program led to the use of two analytical frameworks. The first relates to student variables; the second to program variables,

thus providing a two-factor design in which Factor A describes the basic student objectives and Factor B describes the student population. (Fig.I) B1 indicates seventh grade students, B2 ninth grade students and B3 eleventh grade students.

FIG.I
TWO FACTOR DESIGN FOR EVALUATION OF THE STEP PROGRAM



Beginning with Year Two, there will be new students in the program who were not participants during the program's first year. Thus, there will eventually be students at each grade level 7 to 12.

Comparison of their experience with that of the initial cadre of fifty-two students will allow for a more complex and richer analysis of first year data. In addition, it is planned to establish comparison groups of students who are not part of the STEP program. Establishing comparison groups with similar backgrounds to the STEP students, and with different backgrounds would allow us to more accurately determine the extent of the impact of the program.

DATA COLLECTION

An overview of the measurement tools used to determine student outcomes expressed in the evaluation objectives is presented in Table I. Standardized tests such as CTBS and PSAT's taken from school records.

TABLE I

STUDENT OUTCOME MEASUREMENT TOOLS

OBJECTIVES	STANDARD TESTS	STEP TEACHER ASSESSMENTS	ROSENBERG BROOKOVER	FACULTY FEEDBACK WEEKLY REPORTS	RAVEN'S MATRICES	GRADE POINT AVERAGES
Communica -tion Math & Science	X	X		X		X
Scientific Inquiry (Critical Thinking)		X		X	X	
Self Esteem Achievement Responsibil ity			X	X		
Career Awareness				X		
School Attendance	X	X				

NOTES: 1. Standardized tests administered yearly by the school district CBTS and SAT will be used.

2. STEP teachers pre and post test will be administered at the beginning and end of each phase of the program.

3. Self-concept and critical thinking measures will be administered yearly.

Two sets of instruments were used to acquire initial measures of student self-esteem and achievement responsibility The first was a ten-item Rosenberg scale of self-esteem and th second was the Brookover eight-item measure of self-concept of academic ability.

Self-Esteem

The influence of self-concept on classroom behavior and performance has been of continual interest to educators and researchers for many years (Haggard 1981). Moreover, research findings leave little doubt that better students tend to have higher self-concept. Studies using a variety of measures of b scholastic competence and self-concept have demonstrated this relationship (Fine 1986). But while the positive relationship between level of self-concept and academic achievement has bee well documented, the relationship between self-esteem and academic achievement has also been found across a wide variety studies in which these terms, self-concept and self-esteem, ha similar definitions.

Generally, researchers theorize that students, regardless their level and pattern of particular talents, should experien a school setting that will strengthen, not damage their self-concept and self-esteem. The school should help students at a levels of talent achieve feelings of success and of acceptance that are important in relating appropriately to others and in becoming successful members of society.

One self-esteem scale that seemed to meet the demands of

this evaluation was constructed by Rosenberg (1965). His study presents the results of a large-scale survey focusing exclusively on the way adolescents see and feel about themselves. The survey deals with several dimensions of the self and devotes considerable attention to self-value. But the main concern, or the pivotal variable is self-esteem. In other words, what is the direction of the self-attitude? Does the individual have a favorable or unfavorable opinion of himself? Does he consider himself worthy or unworthy? The main aim of the study was to specify the bearing of certain social factors on self-esteem and to indicate the influence of self-esteem on socially significant attitudes and behavior.

Rosenberg selected items which openly and directly dealt with the dimension under consideration. Respondents were asked to strongly agree, agree, disagree, or strongly disagree with items such as:

1. On the whole, I am satisfied with myself.
2. At times I think I am no good at all.

The full set of items is presented in the section on results.

"Positive" and "negative" items were presented alternately to reduce the effect of respondent set. There is little doubt that the items generally deal with a favorable or unfavorable attitude toward oneself. The criteria of ease of administration, economy of time, unidimensionality, and face validity seem to meet both practical and theoretical demands.

Academic Ability

Students' perceived self-concept of academic ability (SSCOA) was measured by an instrument developed by (Brookover, 1962).

The SSCOA scale, designed by the Michigan State University research team under the leadership of Wilbur Brookover, measures the "self-concept of ability as a learner in school for academic subjects". As noted in the Michigan study, this was the first instrument developed to measure self-concept of academic ability.

Our modified version is a set of eight multiple choice questions designed to test the students' perception of a) their ability to achieve and b) the importance of grades.

The format of the instrument is illustrated by two sample items:

1. How do you rate yourself in school ability compared to your close friends?

I am the poorest	I am below average	I am average	I am above average	I am the best

2. What kind of grades do you think you are capable of getting.

Don't care about any particular grade	Mostly D's	Mostly C's	Mostly B's	Mostly A's

Students are asked to circle the answer which best answers each question.

Critical Thinking

In recent literature, the term "critical thinking" has been a frequently discussed consistent topic in education circles, occurring with insistent regularity in the associated literature. Despite a general consensus of opinion that to think "critically" is a major constructive skill to be fostered and promoted in all students, such ostensible unity tends to crumble when "critical thinking" requires a definition. Therefore in order to ascertain clarity for the study we have provided a definition of "critical thinking".

Critical thinking involves a certain judicious use of reflective skepticism. It does not take purported truth for granted. It considers alternative hypotheses and possibilities. "In part, critical thinking involves seeing when a certain common procedure is fruitless by entertaining alternatives to it". (McPeck 1981). In addition, critical thinking is productive; it seeks optimal solutions. Above all it involves knowing something about the field in question so as to trigger or produce "useful" questions. It cannot exist in isolation from experience, and therefore cannot justifiably be taught in isolation in the classroom.

In light of this definition we may conclude that any general (ie., not subject specific) test of critical thinking must be a measure of both observation and clear thinking (cognitive processes), and cannot simply be an instrument for testing general intelligence.

The Raven's Progressive Matrices Scale (1938-1983),

developed in Britain by John C. Raven is designed to test critical thinking and cognitive ability, and is considered a relatively non-biased test of these skills. It is the quest for reduction of test bias when measuring cognitive abilities of school children, particularly in communities with ethnically diverse populations, or with large groups of economically disadvantaged and/or under represented peoples, which has prompted the search for "culture-fair" instruments.

Raven's Colored Progressive Matrices (1947), in particular, are believed to be, if not completely "culture-fair", then certainly "culture-reduced", mainly because they correlate highest with WISC Block Design subtests and lowest with Information scores as found by Martin and Wiechers (1954). The value of such an instrument for use among the culturally-diverse school populations of many urban American schools is justifiably increased in view of the perspectives offered by the range of tests most frequently used to measure thinking skills.

The two most commonly used tests for measuring critical thinking are the Watson-Glazer Critical Thinking Appraisal and the Cornell Critical Thinking Tests. John E. McPeck in his book "Critical Thinking and Education" (1981) argues that:

> neither test, in fact, measures critical thinking in any reasonable sense because, first, neither the tasks nor the results of these tests show any significant difference from those involved in "general intelligence" (that is, IQ); the tests preclude the use of critical thinking in any defensible sense of that term.

On the other hand, McPeck does acknowledge that Cornell is an improvement over Watson-Glazer in two respects. First, the directions are clearer and straightforward, and the tasks involved are a direct manifestation of the instructions. Second, the authors recognize the difference between "self-contained" questions and "open" (or divergent) questions.

Another widely-used test of cognitive ability is the Ross Test of Higher Cognitive Processes which purports to measure, among other skills, those of comprehension of relationships among ideas, recognition of logical fallacies in arguments and distinguishing a conclusion from supporting statements.

Nonetheless, although the test's authors contend that it is not a measure of intelligence, due to the low correlation between the Ross test and the Lorge-Thorndike Intelligence test, there is little actual evidence to support their claim that the Ross Test measures higher level thinking.

Evidence to support the case for increasing the use of Raven's Progressive Matrices comes from a variety of sources, not the least of which is the application of the Matrices scale in research requiring a "culture-fair" test of critical thinking.

"The Matrices test devised by (Raven's, 1966) is a means to assess a person's present ability to perceive and think clearly, irrespective of past experiences or present ability for verbal communication. They are a test of observation and clear thinking".

M. Maqsud (1983), in his study of the relationships of locus

of control to self-esteem, academic achievement, and predication of performance used the Raven's Standard Progressive Matrices (RSPM) as an instrument to measure his subjects' levels of cognitive ability because "there is evidence (Burke, 1958) that the RSPM is least affected by cultural values". Maqsud found significant correlations between internal/external locus of control scores and RSPM scores among his Nigerian schoolboy subjects.

The Raven's Colored Progressive Matrices (CPM) were administered to subjects of Sewell and Walker's (1982) study of the effects of material and symbolic incentives on the learning ability of low SES black children. The Raven's CPM was accepted by the examiners as a widely-used test of cognitive ability in low socioeconomic subjects.

This latter assertion is not consistent with the findings of both the 1983 and 1979 U.K. standardizations, in which the test items scaled in the same way in all socio-economic groups. The work of Hoffman (1983) suggests that the same is also true of different ethnic groups within the United States.

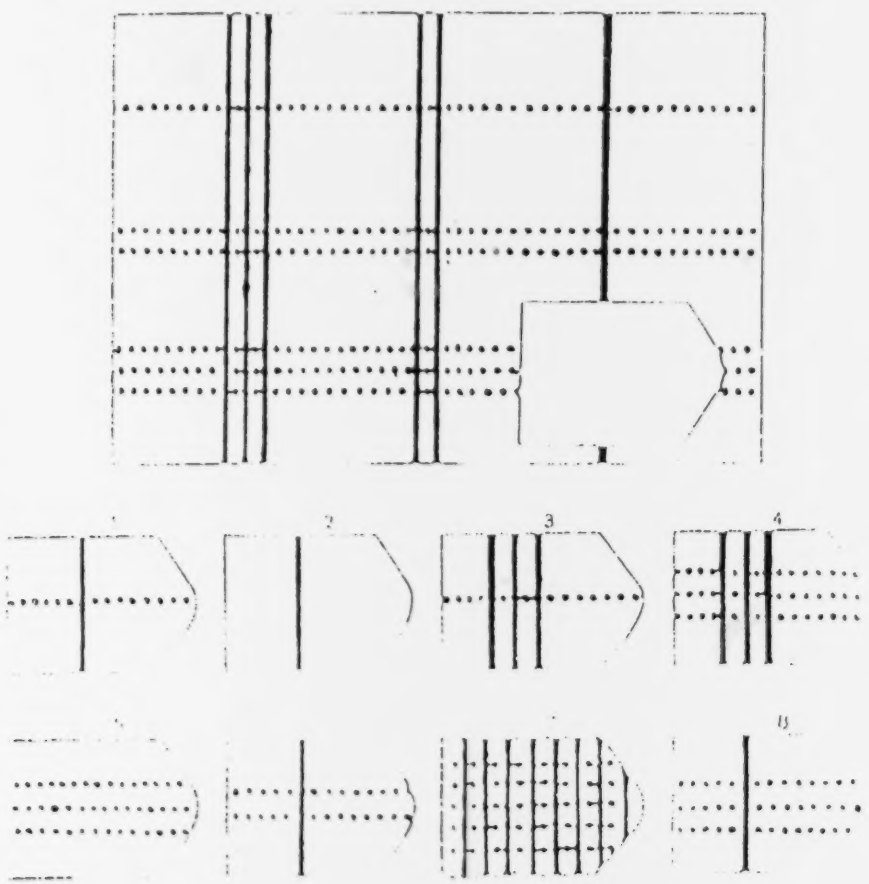
"The differences in mean scores between children coming from different backgrounds (which are, in any case, minor compared with the variation between children from similar backgrounds) cannot, therefore, be explained by saying that the Tests are "foreign to the way of thought" of children from certain backgrounds. (Raven, 1985).

The Raven's Progressive Matrices are a widely accepted

"culturally-fair" test of cognitive ability, as opposed to a general intelligence test which is indubitably bound to discriminate between subjects' cultural and social backgrounds.

The Matrices presented the students with 36 problems in the form of a pattern with a piece taken out of it. The task is to select the missing piece from eight choices that are presented below the pattern (see figure II for sample problem). The problems from 1 to 36 become progressively more difficult, hence the name progressive matrices.

FIGURE II - SAMPLE PROBLEM: RAVEN'S PROGRESSIVE MATRICES



This test of observation and clear thinking is relatively easy to administer and score and is particularly useful for students wishing to pursue science or technical studies as long as the relative importance of other features is also considered.

RESULTS

Student Recruitment: Given the program's late starting date due to late notification of the award, recruiting efforts were highly successful. The program was designed for sixty students. Eighty students applied and 52 were accepted in the program - 20 seventh graders, 16 ninth graders and 16 eleventh graders. The success of the recruitment effort was due in large part to the cooperation that exited between the Manhattanville Administration and the Woodlands High School staff. On the whole, enrollment remained steady throughout the year at around 52 students, (49 in the fall and 52 in the spring).

Sixty-one students participated in the STEP Program, 22 eleventh graders, 19 ninth graders and 20 seventh graders. About sixty percent of the students were males (37 out of 61). All students were black, hispanic, or Asian; the vast majority were black (56 out of 61). They ranged in ages from 11-16 (Table II).

TABLE II

STEP STUDENTS BY GRADE AND ETHNICITY

		NO.	M	F	BLACKS	HISPANIC	ASIAN
GRADES	11	22	10	11	18	3	1
	9	19	5	14	19	0	0
	7	20	8	12	19	1	0
	TOTAL	61	24	37	56	4	1

The variance in attendance for each STEP period was due to some students dropping and others being added to the program. Apparently enrollment also depends on other activities at the high school. For example, in the fall some eleventh graders were involved in athletics and in the spring one group of students was involved in a trip to Africa. Eleventh graders were attracted to the spring session because of the internship program.

STUDENT OUTCOMES

Scientific Inquiry - critical thinking: A major objective of the study was to assess the progress and performance of students with regard to (A1) scientific inquiry or critical thinking (A2) self-esteem, and (A3) standardized tests. As indicated earlier, the Raven's Advanced Progressive Matrices were used to measure critical thinking. The matrices presented the students with 36 problems in the form of a pattern with a piece taken out of it. The task was to select the missing piece from eight choices that

were presented below the pattern (see Figure I for a sample problem). The problems from 1 to 36 become progressively more difficult, hence the name progressive matrices. Two types of results are reported here. First, the test is normed on the basis of age (12 to 20), hence the total number of correct answers was one basis for analyzing the results and determining percentile rank.

Seventeen seventh graders tool the test and eleven scored in the 90-95th percentile. Six of the fifteen ninth graders taking the test scored in the 90-95th percentile and eight of the sixteen eleventh graders scored in the 90-95th percentile. Overall, 25 of the 45 students or 57 percent scored in the 90-95th percentile range (Table IV).

TABLE IV

PERCENTILE SCORES OF STEP STUDENTS ON THE RAVEN'S

	BELOW 50%		50-74%		75-89%		90-95%		TOTAL N
	#	%	#	%	#	%	#	%	
GRADE 11	2	15	2	15	1	8	8	62	13
GRADE 9	1	8	1	8	5	38	6	46	13
GRADE 7	1	6	1	6	4	24	11	65	17
TOTALS	4	9	4	9	10	23	25	58	43

That means that nearly half of the 52 STEP students demonstrated excellent observation and clear thinking skills. Although these tests were administered after the program began, it cannot be determined at this juncture if there was any program impact. However, it is clear that these students, in general, have ability to do scientific studies.

To determine a more in depth understanding of the performance of students on the Raven's test, we analyzed the common errors and error type by grade.

Four types of errors can be identified:

A. Incomplete solutions. These were errors due to people failing to grasp all the variables determining the nature of the correct figure required to complete a test item. Instead, they chose a figure which was right as far as it went but was only partly correct.

B. Arbitrary lines of reasoning. Here the figure chosen suggests that the person has used a principle of reasoning qualitatively different from that demanded by the problem.

C. Over-determined choices. These were errors involving failure to discriminate irrelevant qualities in the figure chosen, and to choose a figure which combined as many as possible of the individual characters shown in the matrix to be completed.

D. Repetitions. These are errors made by people who simply selected a figure identical with one of the three figures in the matrix immediately adjacent to the space to be filled.

Tables V, VI, and VII show the position and nature of the two most common errors made at three levels of difficulty. Since our sample of students taking the test was small (48), we were not able to determine the most common error for some items, nor were we able to determine the second most common error for some items.

For each grade level however, we were able to determine (1) the number and percentage of students who chose the correct figure to solve each problem and (2) the frequency with which each of the seven erroneous figures were chosen. Errors due to failure to attend to all relevant aspects of the problem i.e. incomplete correlate errors, are clearly the most frequent across all three grade levels, accounting for more than a third of the erroneous selections made at all levels of difficulty.

Errors due to applying the wrong principle to the solution of a problem were, if anything most frequent at the lowest level of difficulty but probably not significantly so. Errors due to confluence of ideas and repetition, not very common in any case, declined in frequency of occurrence as the total score increased. The errors of our small sample of 48 students (17 seventh graders, 15 ninth graders and 16 eleventh graders) are almost identical to the larger normed sample reported by Raven's (1983)

in earlier studies. Since the reliability (.91) is relatively high on these untimed tests, we are confident that the identification of errors for our sample is correct.

TABLE V

Position and Nature of Commonest Errors Made
at Three Levels of Ability
For Seventh Grade STEP Students (1988)

A - Incomplete Correlates
B - Wrong Principle
C - Confluence of Idea
D - Repetition

Problem no.	Percentage passes	Correct figures	Commonest error		Second commonest er	
			Position	Nature	Position	Nat
LEVEL 1						
1	76	5	-	-	-	
2	65	1	2	D		
3	88	7	3/4	B	-	
4	76	4	4	-	3/8	
5	88	3	1/4	A	-	
6	65	1	7	D	4/2	
7	70.5	6	2	C	5	
8	47	1	2	-	5	
9	59	8	1	-	3/4	
10	53	4	8	B	1	
11	65	5	3	-	-	
12	76	6	5	B	7/4	
LEVEL 2						
13	29	2	5	-	8	
14	41	1	4	B	3/8	
15	53	2	4/8	C	3/1	
16	41	4	1/8	B	5	
17	53	6	3	A	-	
18	41	7	1/8	A	-	
19	53	3	-	-	-	
20	29	8	2	A	4	
21	29	8	4	B	1	
22	23.5	7	8	C	5	
23	47	6	5/8	BA	1	
24	18	3	-	-	-	
LEVEL 3						
25	23.5	7	2/8	B	4	
26	23.5	2	6/8	CA	3	
27	12	7	6	-	4	
28	18	5	4	A	3	
29	23.5	6	3/7	A	1/8	
30	29	5	3	-	-	
31	18	4	2/5	A	3	
32	29	8	1	-	-	
33	29	5	3	-	8	
34	12	1	3	B	2	
35	6	3	1	B	6	
36	6	2	1	B	4	

TABLE VI

Position and Nature of Commonest Errors Made
at Three Levels of Ability
For Ninth Grade STEP Students (1988)

A - Incomplete Correlates
B - Wrong Principle
C - Confluence of Ideals
D - Repetition

Problem no.	Percentage passes	Correct figures	Commonest error		Second commonest error	
			Position	Nature	Position	Nature
LEVEL 1						
1	67	5	1/2	AA	3	
2	80	1	-	-	-	
3	87	7	8	-	-	
4	73	4	-	-	-	
5	73	3	1	A	2	
6	87	1	2/7	DD	-	
7	67	6	2	C	7/8	
8	47	1	3	-	2/8	
9	93	8	4	B	-	
10	60	4	8	B	2/3	
11	87	5	7/1	A	-	
12	53	6	5	B	7	B
LEVEL 2						
13	47	2	5/6	A	-	
14	67	1	8	-	2/6	
15	47	2	8	-	4/1	
16	67	4	5/1	CB	3	
17	60	6	7	-	-	
18	27	7	1	A	-	
19	47	3	5	A	1/8	A
20	60	8	2/4	AC	5/7	
21	40	8	1	A	4	B
22	20	7	8	C	6	
23	20	6	8	A	5	B
24	27	3	1	B	-	
LEVEL 3						
25	20	7	-	-	-	
26	13	2	5/8	A	-	
27	27	7	4	B	6	
28	20	5	2	-	8	
29	13	6	8	-	5	
30	13	5	2	-	8	A
31	27	4	-	-	-	
32	13	8	7	-	4	A
33	27	5	8	-	2/7	A
34	13	1	5	-	-	
35	1	3	1	B	4	B
36	0	2	1	B	6/8	B

We are somewhat constrained from a more detailed analysis due to the small sample. Our hope is to eventually create norms for the STEP sample as the number of students increase. However our analysis of common errors makes it possible to suggest to teachers and the instructional staff of STEP that more attention be paid to providing experiences where students are asked to identify all of the key variables in solving a problem. This is what is meant by incomplete correlates. To put this another way, students need to make sure that they have all of the relevant information before identifying the solution to a problem.

A second observation is that students need to be taught principles of reasoning and logic in order to avoid making arbitrary judgments when seeking to find a solution to a problem. It is difficult, if not impossible to solve problems consistently if one's logic is incorrect. There are a range of materials and exercises that help students develop and understand deductive or inductive reasoning.

Unfortunately, logic is not a topic that is taught very much in most schools but we believe that it is the basis for improving critical thinking skills for adolescents like those in the STEP program.

Standardized Test Results: At this juncture we have a report on eleventh grade PSAT scores. Apparently these students did not do well on the PSAT given in October of 1988. There were only four students who scored 500 or above, two in math and two on the

verbal section, while five students scored between 440 and 499. Nevertheless, this represented an improvement over a pre-PSAT given in August (see Table VIII). Students taking the test both times averaged 370 in August and 430 in October, a gain of 60 points. It is difficult to determine if these gains were the result of the STEP program, but the scores clearly indicate a move in a positive direction.

TABLE VIII

PSAT RESULTS - 11TH GRADE STEP

I.D.	Math 8/88	MATH Oct 88	VERBAL Oct 88
102	350	410	410
105	470	480	500
116	570	490	450
109	530	590	510
106	300	360	320
113	360	460	350
111	410	N.A.	N.A.
118	N.A.	420	400
104	200	340	250
110	390	N.A.	N.A.
122	N.A.	320	340
103	270	400	360
107	320	430	520
115	290	320	270
112	320	420	280
119	N.A.	370	370
114	390	360	350
101	480	570	360
120	N.A.	350	540
121	N.A.	450	380
Nat'l College Norm		450 (8 below)	410-420 (11 below this #)

In summary, the performance of STEP students on the PSAT compared to their critical thinking ability as indicated by the Raven's Matrices suggests that their PSAT is not commensurate with their ability. It is too early and in any case difficult to determine reasons for this discrepancy. Some would argue that the PSAT and SAT tests are not valid measure of academic ability (Owen, 1989). Clearly steps need to be taken to take advantage of the critical thinking abilities of these students. We suspect that the STEP program, for example, needs to present greater challenges to students in the instructional modules. In any case, there is an overriding need for the program.

Self-Esteem and Achievement Responsibility: The Rosenberg self-esteem scale asks students to (A) Strongly agree (B) Agree (C) Disagree or (D) Strongly disagree with the following statements. Note that the statements are stated both positively (# 1,2,4,6, and 7) and negatively (# 3,5,8,9, and 10).

1. I feel that I'm a person of worth, at least on an equal plane with others.
2. I feel that I have a number of good qualities.
3. All in all, I am inclined to feel that I am a failure.
4. I am able to do things as well as most other people.
5. I feel I do not have much to be proud of.
6. I take a positive attitude toward myself.
7. On the whole, I am satisfied with myself.
8. I wish I could have more respect for myself.

9. I certainly feel useless at times.

10. At times I think I am no good at all.

The results of the scores on the Rosenberg scale of self-esteem revealed in general that STEP students felt good about themselves. The overall positive scores on the ten-item scale averaged above 90 percent.

An item analysis of this scale is underway and will probably provide better clues about students' attitudes toward themselves and schools that can be useful in assisting students in coping with the educational environment. We are also examining the use of more qualitative methodology to examine self-esteem.

The Brookover scale also uses a five-point scale ranging from positive to negative on the following questions:

1. How do you rate yourself in school ability compared to your close friends?

2. How do you rate yourself in school ability compared to those in your class at school?

3. Where do you think you would rank in your class in college?

4. Do you think you have the ability to compete in college?

5. Where do you think you would rank in your class in college?

6. In order to become a doctor, lawyer, or university professor, work beyond four years of college is necessary. How likely do you think it is that you could complete such advanced work?

7. Forget for a moment how others grade your work. In your own opinion, how good do you think your work is?

8. What kind of grades do you think you are capable of getting?

On the surface, student responses to the Brookover scale of achievement responsibility appeared strongly positive. However, a preliminary item analysis suggests that students have doubts about their ability to succeed in academic areas. Nevertheless, they do believe they are capable and see STEP as an avenue toward success.

SUMMARY AND RECOMMENDATIONS

The report presented here is part of a longer more detailed examination of the Manhattanville-Woodlands STEP program (Miller and Repa, 1989). Some of the supporting documents, tables and charts have been omitted. The longitudinal nature of the study and the fact that the study is formative as well as summative means that all of our reports are continuous. Nevertheless we are able to draw some conclusions regarding various aspects of the program.

In regard to the STEP instructional program, there appear to be two major components that can be improved. First is the modules, in terms of (1) curriculum content and (2) critical thinking skills. As we suggested in the section on results, both Woodlands teachers and STEP instructors need to provide students with learning experiences that need to be taught principles of reasoning and logic in order to avoid making arbitrary judgments when seeking solutions so a problem. A closer alignment between math and science content in the instructional modules and school math and science content areas would help the students improve in both areas. Both the high school teachers and the STEP instructors need to focus on critical thinking skills. A staff development workshop might be very useful. The standardized test scores of STEP students do not appear to be commensurate with their critical thinking skills and students need to be presented with greater challenges.

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